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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND  
SALES hereby certify that annexed is a true copy of the Provisional specification  
in connection with Application No. 2003906039 for a patent by SCALZO  
AUTOMOTIVE RESEARCH P/L as filed on 03 November 2003.

WITNESS my hand this  
Twentieth day of January 2004

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JULIE BILLINGSLEY  
TEAM LEADER EXAMINATION  
SUPPORT AND SALES



## **ENGINE MECHANISM.**

This invention relates to variable displacement or stroke, internal combustion engines and more particularly to an arrangement having efficient power-transmitting for stroke varying mechanism whereby the displacement of the pistons is varied by the piston stroke. These types of stroke varying mechanisms are known to contribute substantial fuel economy improvements during part load operation.

Reference is made to Provisional Patent Application No. 2003903018 for a variable stroke piston engine. This mechanism allowed the engine to be switched between its two displacement positions with predetermined compression ratios at these two extreme positions. This mechanism provided a wide variation of compression ratios as it traversed between its two positions and could thus not be fully utilised, if the engine is desired to be operated as a continually variable displacement engine. It is the objective of this invention to introduce a supplementary feature to allow the compression ratio to be kept at a more consistent and useful level throughout its stroke varying range.

The improved feature and advantages of the invention will be more fully understood from the following description of a preferred embodiment taken together with the accompanying drawings.

In the drawings:

Figure 1 is a transverse cross sectional view of one piston/crank assembly of a multi-piston engine, in the minimum displacement condition with the piston at the top-dead-centre position.

Figure 2 is an isometric view of one piston/crank/oscillator mechanism of a multi-piston engine, in the minimum displacement position with the piston at the bottom-dead-centre position, and with the crankcase and other parts removed for clarity.

Figure 3 is an isometric view of one piston/crank/oscillator mechanism of a multi-piston engine, in the maximum displacement condition with the piston at the top-dead-centre position, and with the crankcase and other parts removed for clarity.

Figure 4 is an isometric view of the stroke adjusting shaft, showing the two eccentrics relative to its rotational axis.

Diagram 1 shows the minimum and maximum stroke position of the stroke adjusting shaft and the relative positions of its two eccentrics with the centre of rotation.

Referring to Figs. 1 and 2 of the drawings, an internal combustion engine 10 having a cylinder block 12 defining one of many cylinder bores 14. The cylinders 14 are closed at one end by a cylinder head which is provided with the usual inlet and exhaust port, valves, actuating gear and ignition means, none of which are shown.

Piston assembly 16 moves in bore 14 and connects to a pair of rocking members 18, only one of which is shown for clarity, via connecting rod 20 and forked link 22.

Connecting rod 20 is pivotally connected to the piston 16 via gudgeon pin 24, and pivotally connected to the forked link 22 via pin 26. The other end of the forked link 22 is pivotally linked to the rocking member 18 by pin 28 journalised on either side of the pair of rocking members 18. The axes of pins 24, 26 and 28 are parallel to each other.

Referring to Figures 2 and 4, adjusting shaft 30 is rotatable via journals 58 and 60 on respective bearings within the engine block 12 webs (not shown) separating the cylinder bores 14 and crankshaft 32 on conventional main bearings (not shown).

Adjusting shaft 30 has eccentric pin 34 represented by position 'B' in diagram 1, rotatably connected to connecting rod 36 linked to forked link 22 via pin 38 and is positioned in a selected geometric position longitudinal along the engine block 12 and parallel to the engine crankshaft 32 and all of the pins 24, 26 and 28.

Rocking members 18 are rotatably supported on concentric eccentrics 62 and 64 of adjusting shaft 30. Eccentrics 62 and 64 allow for the compression ratio to be kept within acceptable limits and its stroke is small relative to the stroke adjusting eccentric 34 represented by position 'A' in diagram 1. Also, the rotational centre of eccentrics 62 and 64 is generally positioned opposite to the centerline bisecting the rotational angle of the adjusting shaft 30 between minimum and maximum stroke positions. Refer to diagram 1.

The rocking member 18 connects to the crankshaft 32 via connecting rod 40, pin 42, fixed at either end to the rocking member 18, and crankpin 44. The position of pin 42 can be placed in a suitable radial position on the rocking member 18 or it can be in a combined position with pin 28, to transmit the oscillating motion to the crankshaft 32. Thus the linear piston 16 motion is transferred to the crankshaft 32 via connecting rod 20, forked link 22, rocking member 18 adjusting shaft 30, and connecting rod 40.

The geometry of the linkage system as represented in Fig. 1 shows the engine 10 in the minimum displacement position with the piston 16 at top-dead-centre. The connection at pin 26 by connecting rod 20 and forked link 22 is held in position by connecting rod 36 pivotally connected to eccentric pin 34 on adjusting shaft 30. The position of the eccentric pin 34 and eccentrics 62 and 64 is controlled by the rotational position of adjusting shaft 30 which is in turn controlled by an electronic engine management

system via a rotary actuator system fully described in Patent Application No. 2003903018.

Figure 3 represents the engine 10 in the top-dead-centre position at maximum stroke. Adjusting shaft 30 has been rotated, in this preferred embodiment, anti-clockwise and in the same rotational direction of the crankshaft 32, through an angle generally less than 180 degrees. The adjusting shaft 30 can also be rotated in a clockwise rotation, however the position of all eccentrics on adjusting shaft 30 may need to be altered to produce the desired compression ratio characteristic.

The respective geometries of pins 24, 26, 28, 38 and eccentrics 34, 62 and 64, can be selected to provide various piston adjustments and compression ratio variations, as desired by the engine designer.

The scope of the invention need not be limited to the mechanism shown, Variations in the positioning of the crankshaft and the rocking member and the method of altering the position of the linkages, either by hydraulic or mechanical systems, and in addition, the geometry of the linkages to achieve the same outcome, fall within this invention.

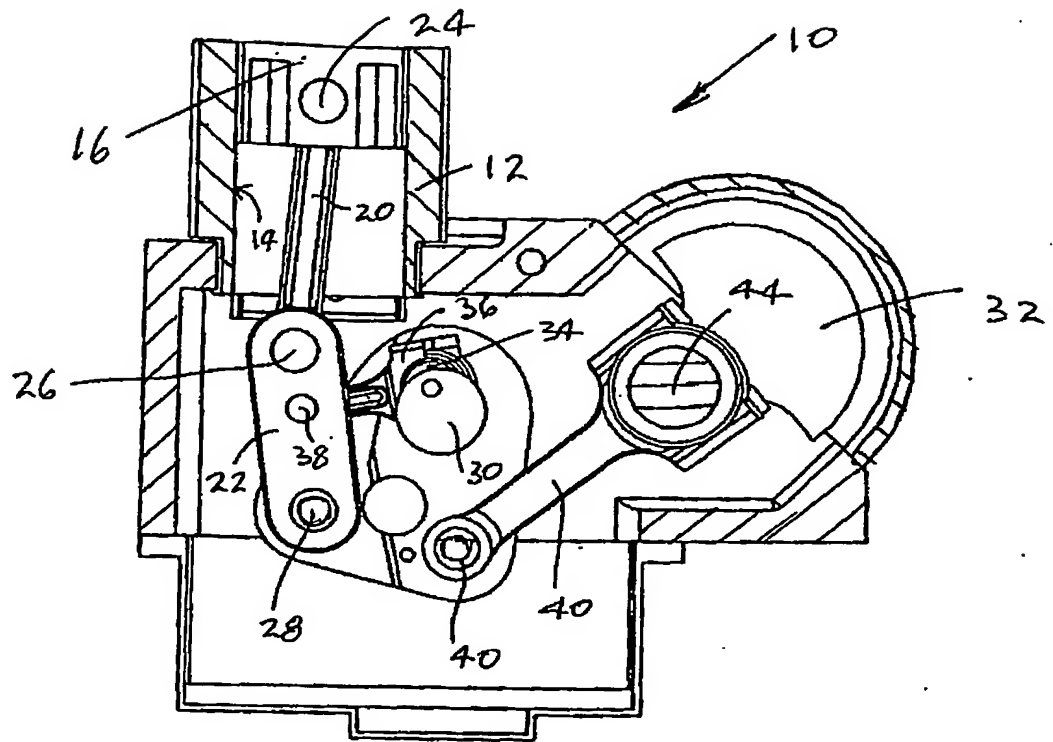


Figure 1

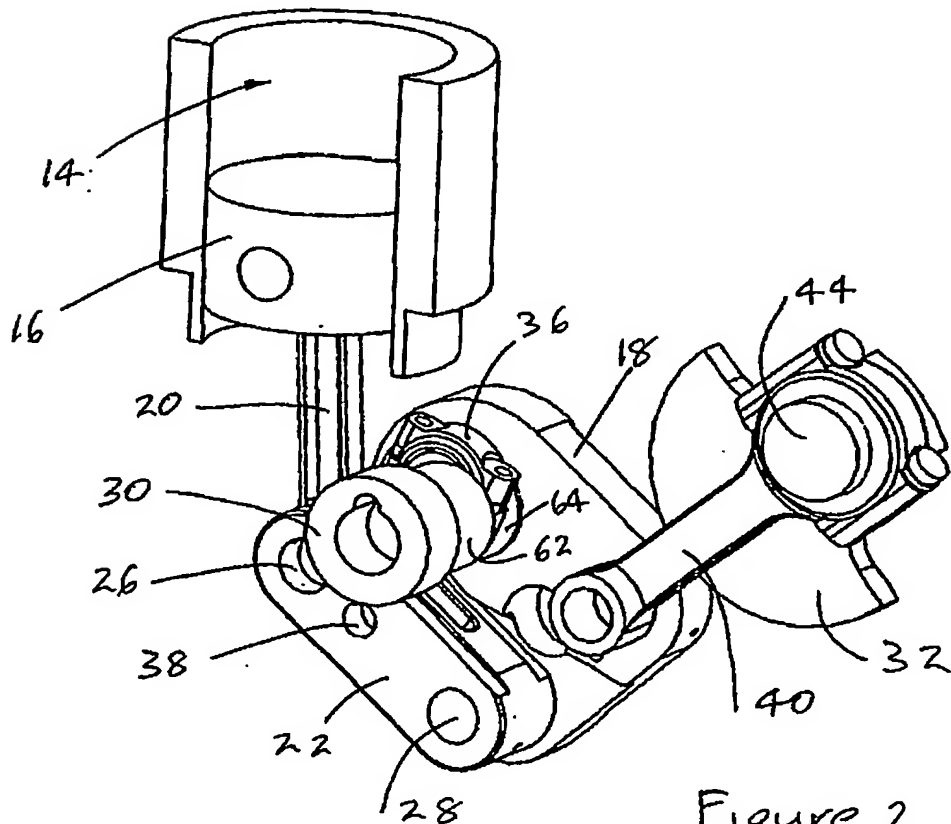


Figure 2

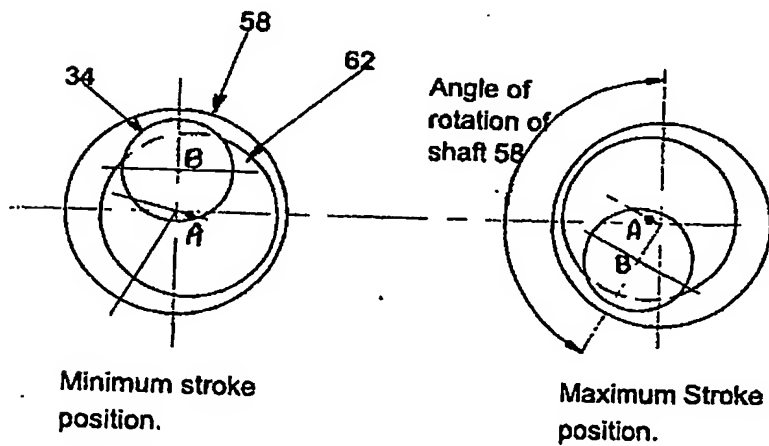
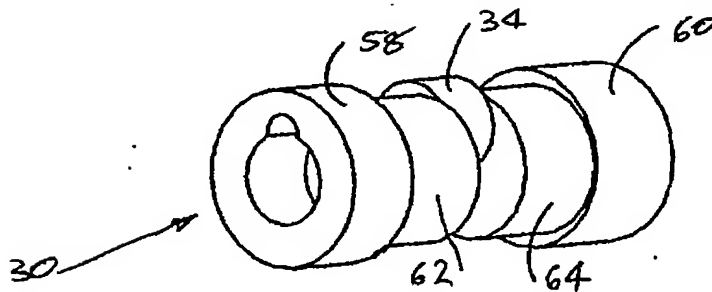
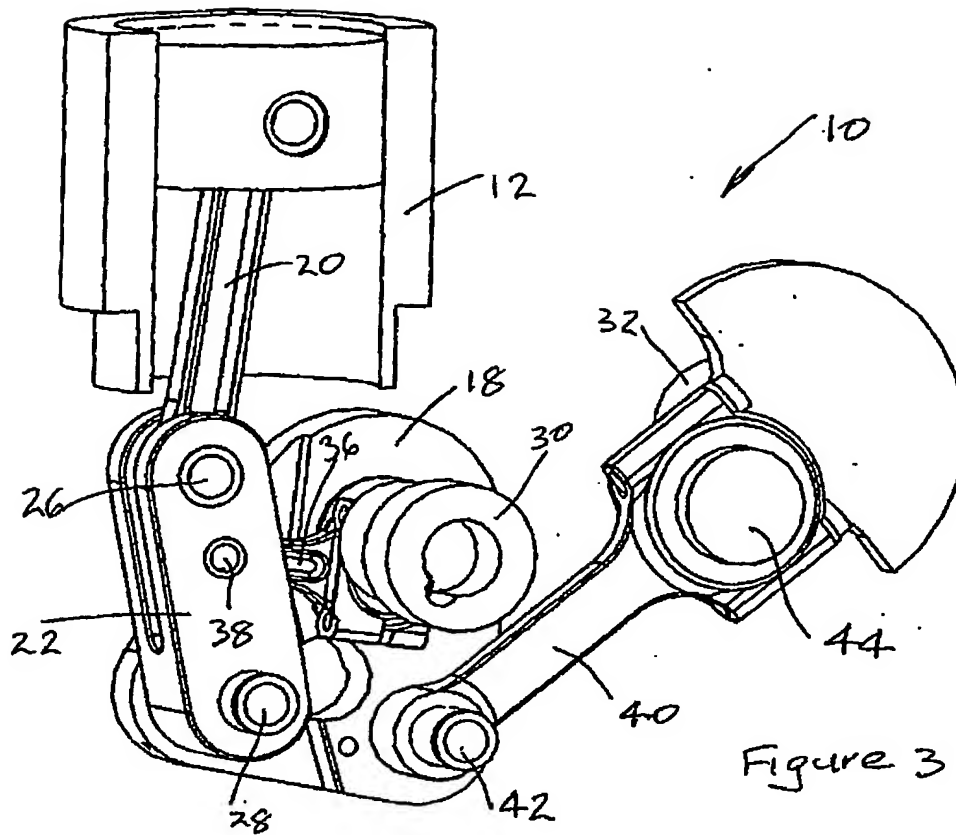


Diagram 1.